A mutual impedance probe for measuring the dielectric properties of the atmosphere and of the surface of planetary environments.

F. Simões[1], R. Trautner[2], R. Grard[2], M. Hamelin[1], J.-P. Lebreton[2]

[1]*Centre d'etude des Environments Terrestre et Planétaires (CETP), CNRS, 4 Avenue de Neptune, 94107 Saint Maur, France, Fernando.Simoes@cetp.ipsl.fr*

[2]*Research and Scientific Support Department (RSSD), ESA/ESTEC, Noordwijk, The Netherlands*

A mutual impedance probe is a suitable instrument for measuring the complex permittivity of a medium. A sinusoidal current is injected through two transmitting electrodes and the induced voltage is measured between two receiving electrodes. The variations of the amplitude and phase of the injected signal, with respect to their values in a vacuum taken as references, yields the permittivity and the conductivity of the medium. This technique has been successfully used on the Huygens Probe for measuring the atmospheric conductivity profile of the atmosphere and the dielectric constant of the surface of Titan. A similar instrument is included in the payload of Philae, the Rosetta lander, for measuring the surface properties of the comet Churyumov-Gerasimenko.

We describe different applications of the mutual impedance probe to the characterization of planetary environments. During the descent phase, this probe can possibly measure the complex permittivity of the ionosphere and the conductivity of the atmosphere. The sensor can also be mounted on landers, rovers, tails, drills and moles, for measuring the water/ice content of the soil and performing stratigraphic studies of the subsurface. Several electrode configurations are presented and discussed, depending upon scientific goals, host vehicle constraints, and performance requirements.